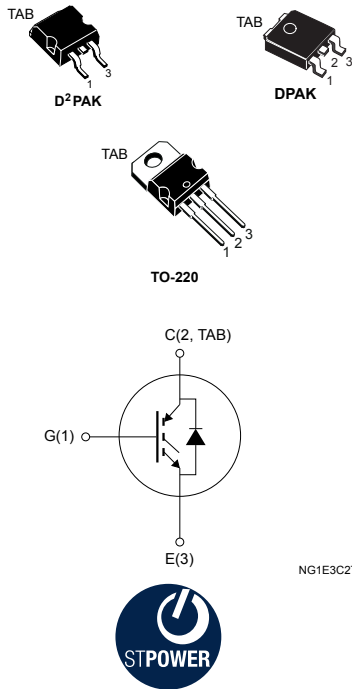




STGB8NC60KDT4, STGD8NC60KDT4, STGP8NC60KD

Datasheet

8 A, 600 V short-circuit rugged IGBT



Features

- Lower on voltage drop ($V_{CE(sat)}$)
- Lower C_{res} / C_{ies} ratio (no cross-conduction susceptibility)
- Very soft ultra-fast recovery antiparallel diode
- Short-circuit withstand time 10 μ s

Applications

- High frequency motor controls
- SMPS and PFC in both hard switch and resonant topologies
- Motor drives

Description

These devices are very fast IGBTs developed using advanced PowerMESH technology. This process guarantees an excellent trade-off between switching performance and low on-state behavior. These devices are well-suited for resonant or soft-switching applications.

Product status links

[STGB8NC60KDT4](#)

[STGD8NC60KDT4](#)

[STGP8NC60KD](#)

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		D ² PAK, TO-220	DPAK	
V _{CES}	Collector-emitter voltage (V _{GE} = 0 V)	600		V
I _C ⁽¹⁾	Continuous collector current at T _C = 25 °C	15		A
	Continuous collector current at T _C = 100 °C	8		
I _{CL} ⁽²⁾	Turn-off latching current	30		A
I _{CP} ⁽³⁾	Pulsed collector current	30		A
V _{GE}	Gate-emitter voltage	±20		V
I _F	Diode RMS forward current at T _C = 25 °C	7		A
I _{FSM}	Surge non repetitive forward current t _p = 10 ms sinusoidal	20		A
t _{scw}	Short-circuit withstand time V _{CE} = 0.5, V _{CES} , T _J = 125 °C, R _G = 10 Ω, V _{GE} = 12 V	10		μs
P _{TOT}	Total power dissipation at T _C = 25 °C	65	62	W
T _{stg}	Storage temperature range	-55 to 150		°C
T _J	Operating junction temperature range			°C

1. Calculated according to the iterative formula:
$$I_C(T_C) = \frac{T_{J(max)} - T_C}{R_{thJC} \times V_{CE(sat)(max)}(T_{J(max)}, I_C(T_C))}$$
2. V_{clamp} = 80% V_{CES}, T_J = 150 °C, R_G = 10 Ω, V_{GE} = 15 V.
3. Pulse width limited by maximum junction temperature and turn-off within RBSOA.

Table 2. Thermal data

Symbol	Parameter	Value		Unit
		D ² PAK, TO-220	DPAK	
R _{thJC}	Thermal resistance, junction-to-case IGBT	1.9	2.0	°C/W
	Thermal resistance, junction-to-case diode	4	4.5	
R _{thJA}	Thermal resistance, junction-to-ambient	62.5	100	°C/W

2 Electrical characteristics

$T_C = 25\text{ °C}$ unless otherwise specified

Table 3. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage	$V_{GE} = 0\text{ V}$, $I_C = 1\text{ mA}$	600			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15\text{ V}$, $I_C = 3\text{ A}$		2.2	2.75	V
		$V_{GE} = 15\text{ V}$, $I_C = 3\text{ A}$, $T_J = 125\text{ °C}$		1.8		
$V_{GE(th)}$	Gate threshold voltage	$V_{CE} = V_{GE}$, $I_C = 250\text{ }\mu\text{A}$	4.5		6.5	V
I_{CES}	Collector cut-off current	$V_{GE} = 0\text{ V}$, $V_{CE} = 600\text{ V}$			0.15	mA
		$V_{GE} = 0\text{ V}$, $V_{CE} = 600\text{ V}$, $T_J = 125\text{ °C}$ ⁽¹⁾			1	
I_{GES}	Gate-emitter leakage current	$V_{CE} = 0\text{ V}$, $V_{GE} = \pm 20\text{ V}$			± 100	nA
g_{fs} ⁽²⁾	Forward transconductance	$V_{CE} = 15\text{ V}$, $I_C = 3\text{ A}$		1.9		S

1. Specified by design, not tested in production.

2. Pulsed: pulse duration = 300 μs , duty cycle 1.5%.

Table 4. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	$V_{CE} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GE} = 0\text{ V}$	-	380	-	pF
C_{oes}	Output capacitance		-	46	-	pF
C_{res}	Reverse transfer capacitance		-	8.5	-	pF
Q_g	Total gate charge	$V_{CC} = 390\text{ V}$, $I_C = 3\text{ A}$, $V_{GE} = 0\text{ to }15\text{ V}$ (see Figure 18. Gate charge test circuit)	-	19	-	nC
Q_{ge}	Gate-emitter charge		-	5	-	nC
Q_{gc}	Gate-collector charge		-	9	-	nC

Table 5. Switching on/off (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 390\text{ V}$, $I_C = 3\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$ (see Figure 16. Test circuit for inductive load switching and Figure 19. Switching waveform)	-	17	-	ns
t_r	Current rise time		-	6	-	ns
$(di/dt)_{on}$	Turn-on current slope		-	655	-	A/ μ s
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 390\text{ V}$, $I_C = 3\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$ (see Figure 16. Test circuit for inductive load switching and Figure 19. Switching waveform)	-	16.5	-	ns
t_r	Current rise time		-	6.5	-	ns
$(di/dt)_{on}$	Turn-on current slope		-	575	-	A/ μ s
$t_r(V_{off})$	Off voltage rise time	$V_{CC} = 390\text{ V}$, $I_C = 3\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$ (see Figure 16. Test circuit for inductive load switching and Figure 19. Switching waveform)	-	33	-	ns
$t_{d(off)}$	Turn-off delay time		-	72	-	ns
t_f	Current fall time		-	82	-	ns
$t_r(V_{off})$	Off voltage rise time	$V_{CC} = 390\text{ V}$, $I_C = 3\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$ (see Figure 16. Test circuit for inductive load switching and Figure 19. Switching waveform)	-	60	-	ns
$t_{d(off)}$	Turn-off delay time		-	106	-	ns
t_f	Current fall time		-	136	-	ns

Table 6. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$E_{on}^{(1)}$	Turn-on switching energy	$V_{CE} = 390\text{ V}$, $I_C = 3\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$ (see Figure 16. Test circuit for inductive load switching)	-	55	-	μ J
$E_{off}^{(2)}$	Turn-off switching energy		-	85	-	μ J
E_{ts}	Total switching energy		-	140	-	μ J
$E_{on}^{(1)}$	Turn-on switching energy	$V_{CE} = 390\text{ V}$, $I_C = 3\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$ (see Figure 16. Test circuit for inductive load switching)	-	87	-	μ J
$E_{off}^{(2)}$	Turn-off switching energy		-	162	-	μ J
E_{ts}	Total switching energy		-	249	-	μ J

1. Including the reverse recovery of the diode.

2. Including the tail of the collector current.

Table 7. Diode switching characteristics (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_F	Forward on-voltage	$I_F = 3\text{ A}$	-	1.6	2.1	V
		$I_F = 3\text{ A}, T_J = 125\text{ °C}$	-	1.3		
t_{rr}	Reverse recovery time	$I_F = 3\text{ A}, V_R = 30\text{ V}, di/dt = 100\text{ A/}\mu\text{s}$	-	23.5		ns
Q_{rr}	Reverse recovery charge	(see Figure 17. Diode reverse recovery waveform)	-	16.5		nC
I_{rrm}	Reverse recovery current		-	1.4		A
t_{rr}	Reverse recovery time	$I_F = 3\text{ A}, V_R = 30\text{ V}, di/dt = 100\text{ A/}\mu\text{s},$	-	39		ns
Q_{rr}	Reverse recovery charge	$T_J = 125\text{ °C}$ (see Figure 17. Diode reverse recovery waveform)	-	39		nC
I_{rr}	Reverse recovery current		-	2		A

2.1 Electrical characteristics (curves)

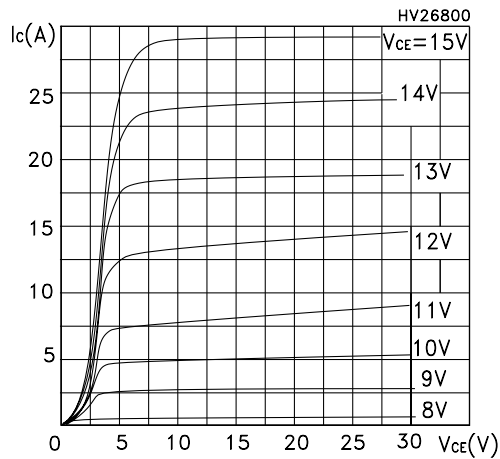
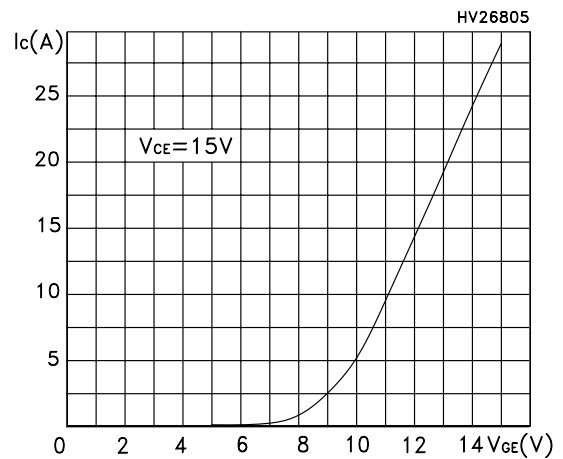
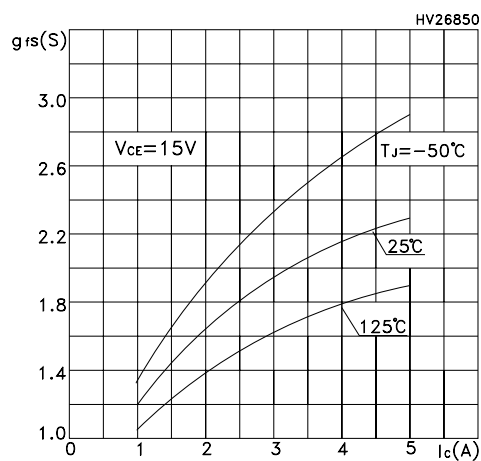
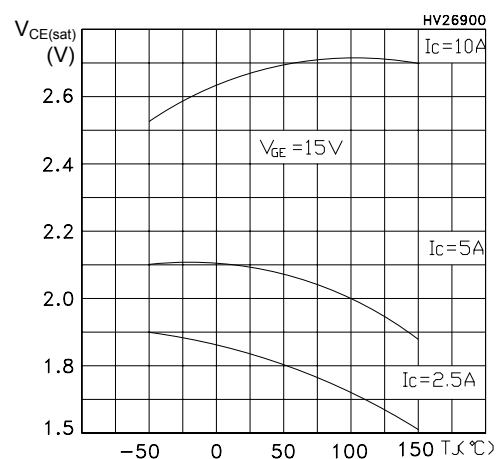
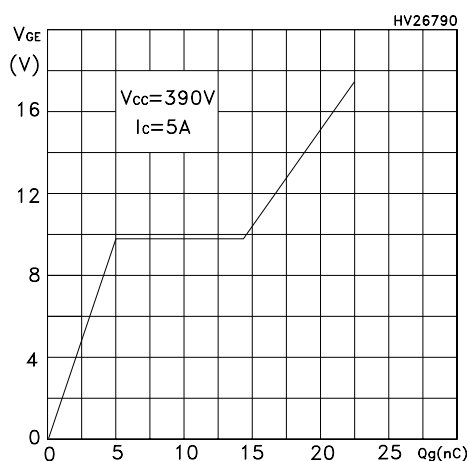
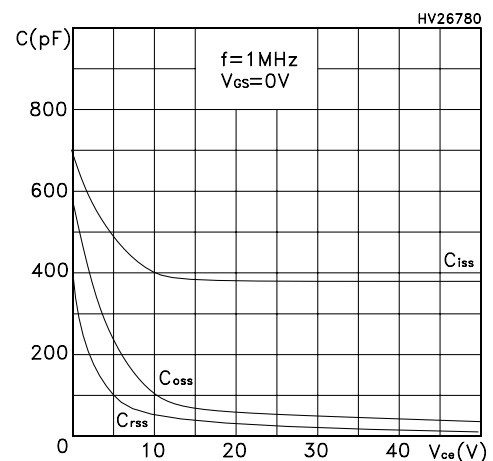
Figure 1. Typical output characteristics

Figure 2. Typical transfer characteristics

Figure 3. Typical transconductance characteristics

Figure 4. Typical collector-emitter on voltage vs temperature

Figure 5. Typical gate charge characteristics

Figure 6. Typical capacitance characteristics


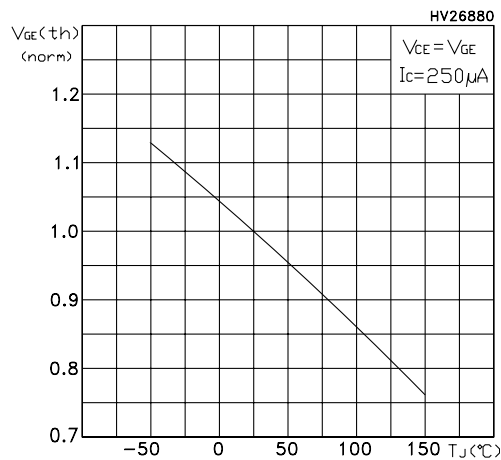
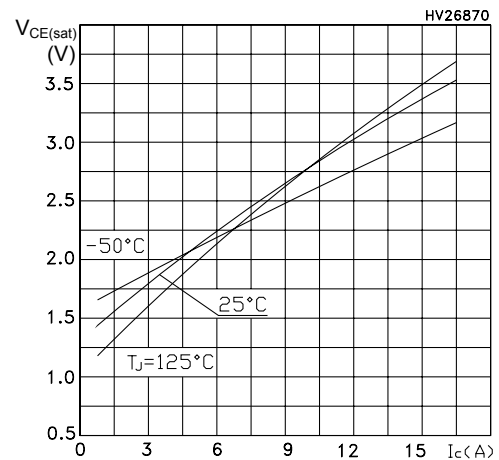
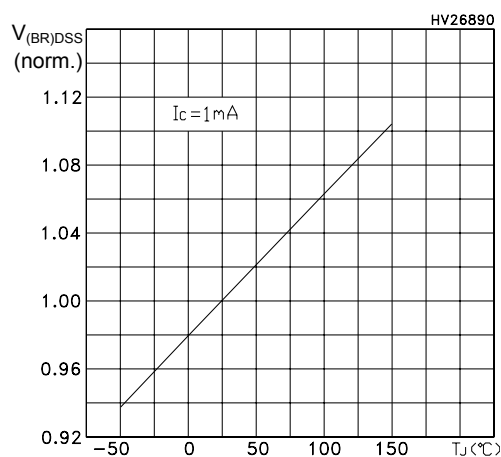
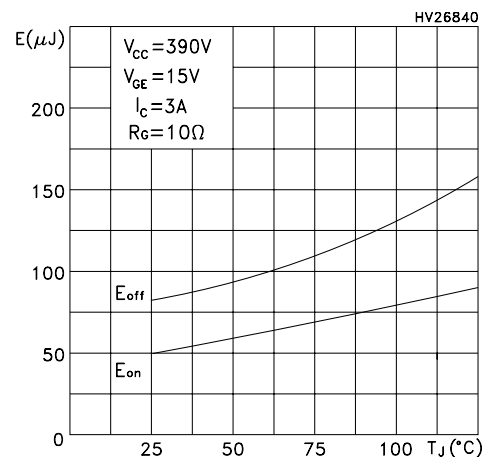
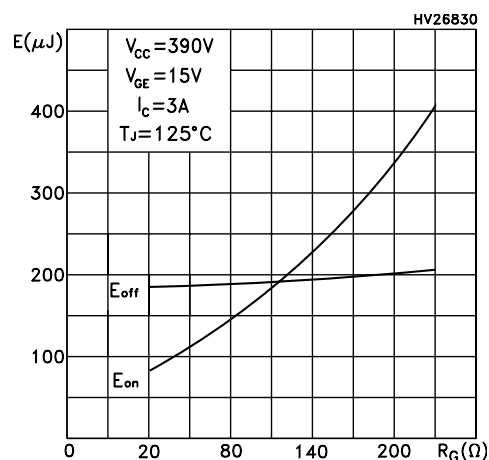
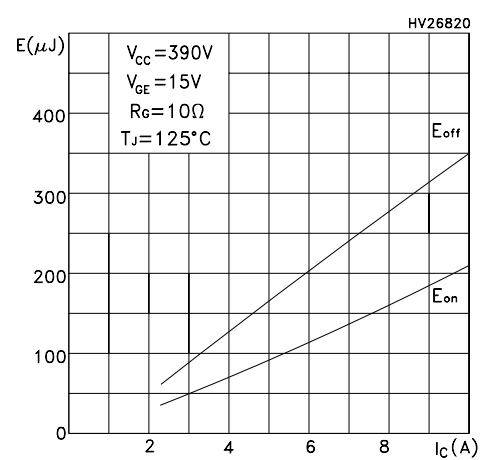
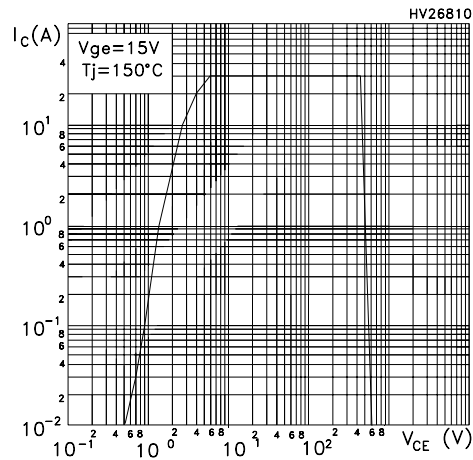
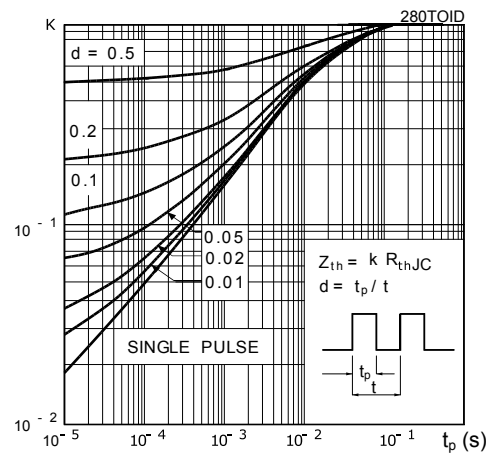
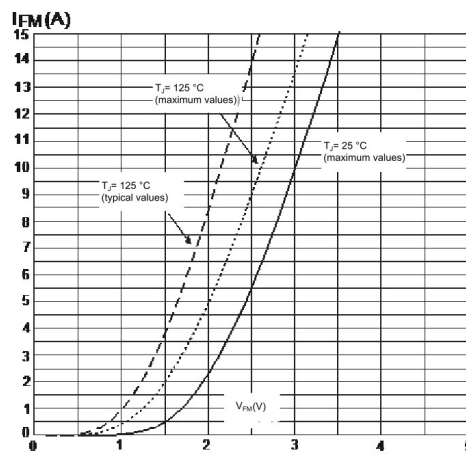
Figure 7. Normalized gate threshold vs temperature

Figure 8. Typical collector-emitter on voltage vs collector current

Figure 9. Normalized breakdown voltage vs temperature

Figure 10. Typical switching energy vs temperature

Figure 11. Typical switching energy vs gate resistance

Figure 12. Typical switching energy vs collector current


Figure 13. Reverse bias safe operating area

Figure 14. Normalized transient thermal impedance

Figure 15. Typical emitter-collector diode characteristics


3 Test circuits

Figure 16. Test circuit for inductive load switching

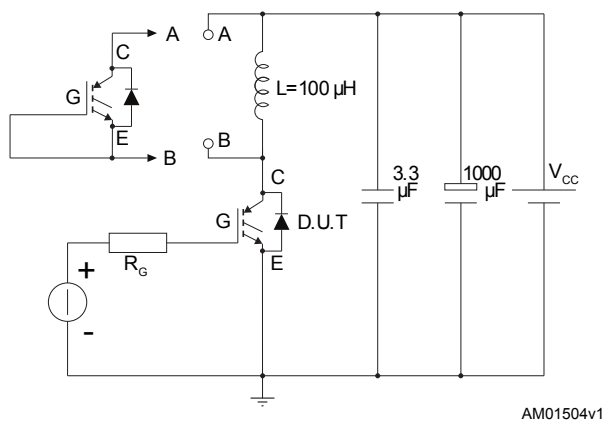


Figure 17. Diode reverse recovery waveform

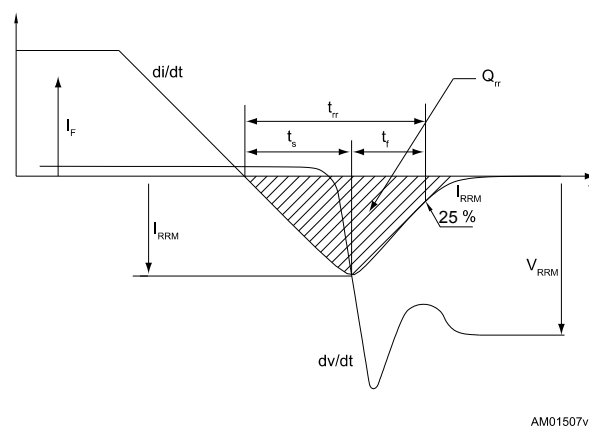


Figure 18. Gate charge test circuit

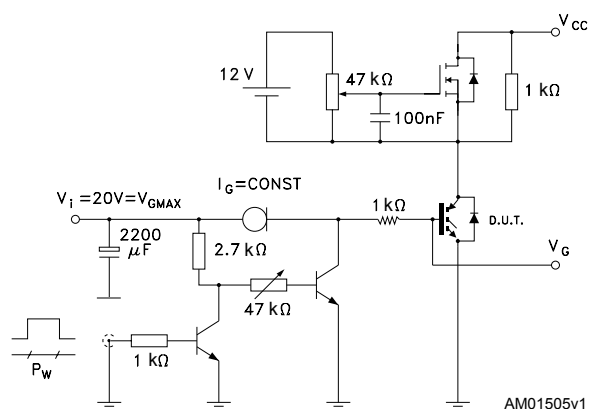
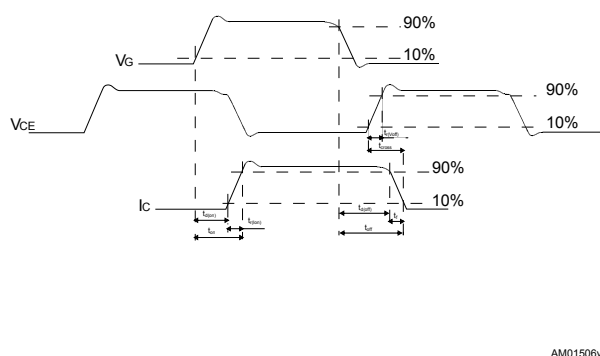


Figure 19. Switching waveform

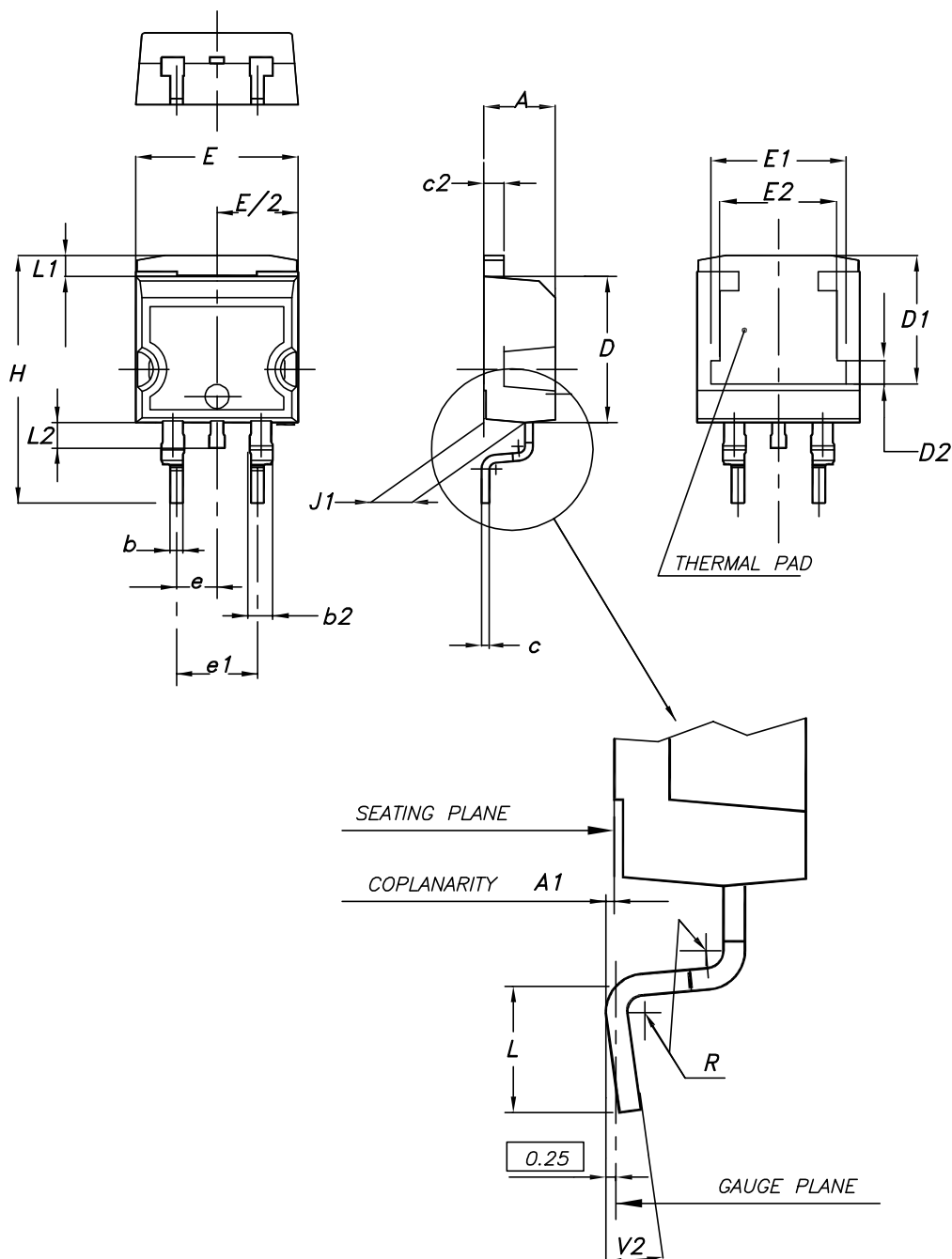


4 Package information

To meet environmental requirements, ST offers these devices in different grades of **ECOPACK** packages, depending on their level of environmental compliance. ECOPACK specifications, grade definitions, and product status are available at: www.st.com. ECOPACK is an ST trademark.

4.1 D²PAK (TO-263) type A package information

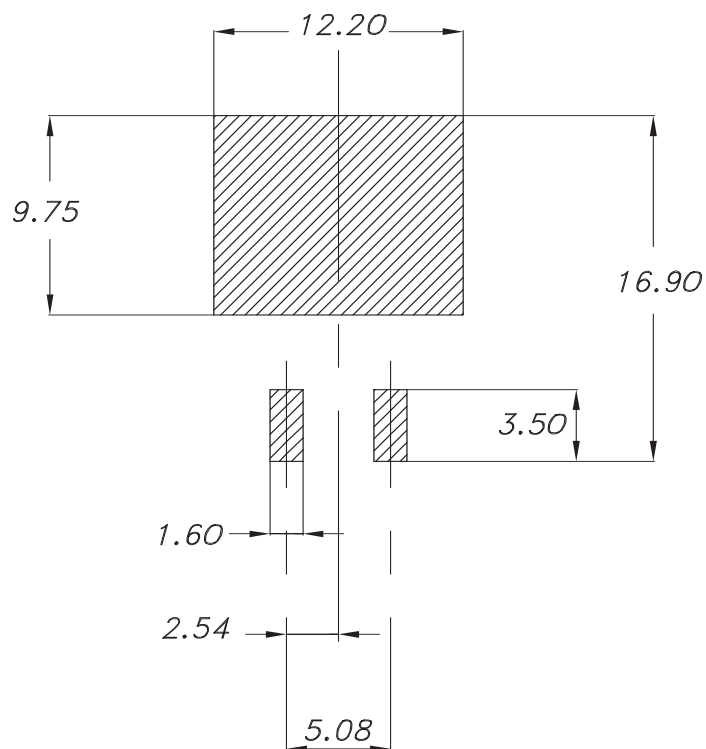
Figure 20. D²PAK (TO-263) type A package outline



0079457_27

Table 8. D²PAK (TO-263) type A package mechanical data

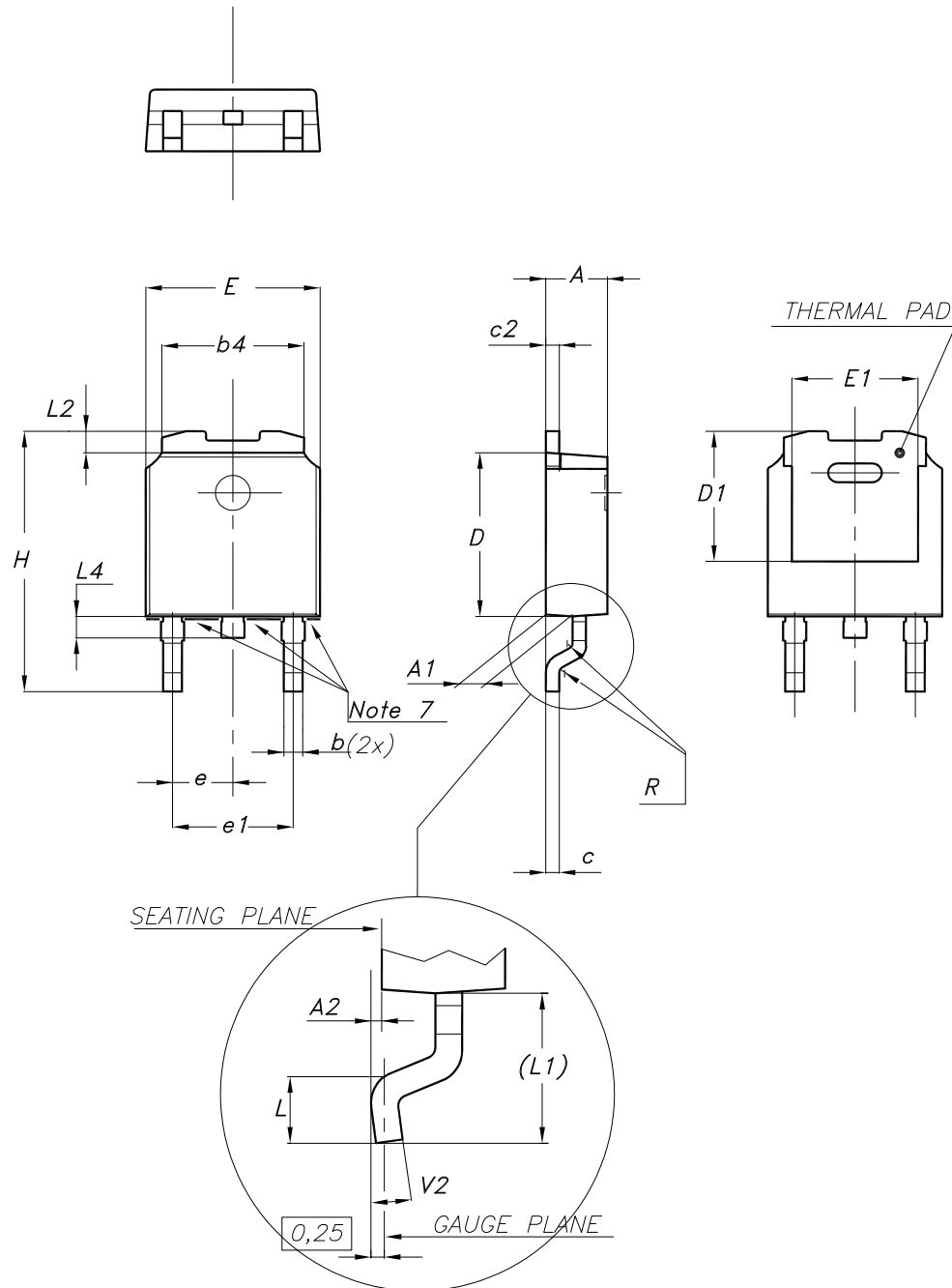
Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
A1	0.03		0.23
b	0.70		0.93
b2	1.14		1.70
c	0.45		0.60
c2	1.23		1.36
D	8.95		9.35
D1	7.50	7.75	8.00
D2	1.10	1.30	1.50
E	10.00		10.40
E1	8.30	8.50	8.70
E2	6.85	7.05	7.25
e		2.54	
e1	4.88		5.28
H	15.00		15.85
J1	2.49		2.69
L	2.29		2.79
L1	1.27		1.40
L2	1.30		1.75
R		0.40	
V2	0°		8°

Figure 21. D²PAK (TO-263) recommended footprint (dimensions are in mm)


0079457_Rev27_footprint

4.2 DPAK (TO-252) type A package information

Figure 22. DPAK (TO-252) type A package outline



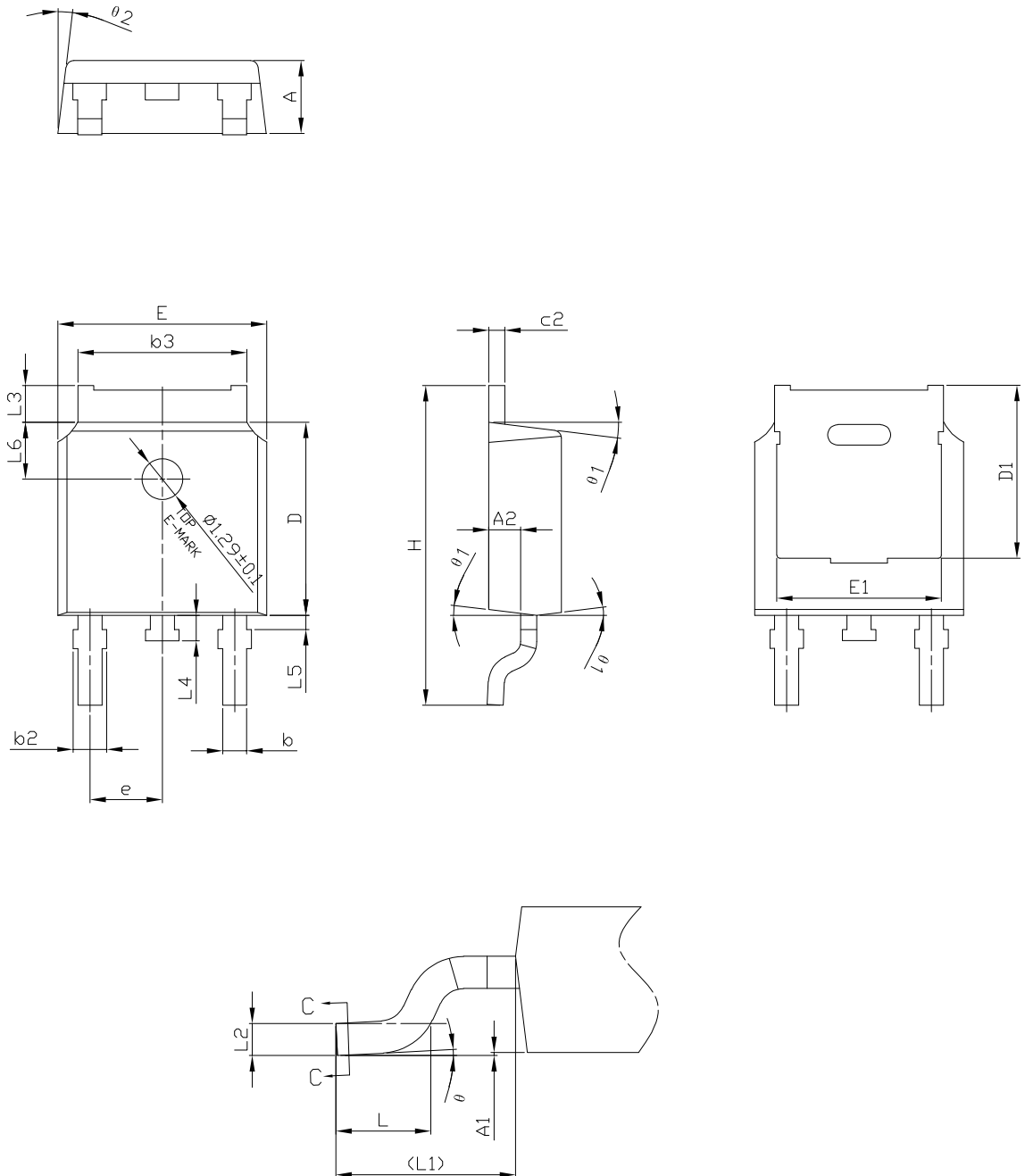
0068772_A_34

Table 9. DPAK (TO-252) type A mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	2.20		2.40
A1	0.90		1.10
A2	0.03		0.23
b	0.64		0.90
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
D1	4.95	5.10	5.25
E	6.40		6.60
E1	4.60	4.70	4.80
e	2.159	2.286	2.413
e1	4.445	4.572	4.699
H	9.35		10.10
L	1.00		1.50
(L1)	2.60	2.80	3.00
L2	0.65	0.80	0.95
L4	0.60		1.00
R		0.20	
V2	0°		8°

4.3 DPAK (TO-252) type C3 package information

Figure 23. DPAK (TO-252) type C3 package outline



0068772_type-C3_rev34

Table 10. DPAK (TO-252) type C3 mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	2.20	2.30	2.38
A1	0.00		0.10
A2	0.90	1.01	1.10
b	0.72		0.85
b2	0.72		1.10
b3	5.13	5.33	5.46
c	0.47		0.60
c2	0.47		0.60
D	6.00	6.10	6.20
D1	5.20	5.45	5.70
E	6.50	6.60	6.70
E1	5.00	5.20	5.40
e	2.186	2.286	2.386
H	9.80	10.10	10.40
L	1.40	1.50	1.70
L1	2.90 REF		
L2	0.51 BSC		
L3	0.90		1.25
L4	0.60	0.80	1.00
L5	0.15		0.75
L6	1.80 REF		
θ	0°		8°
θ1	5°	7°	9°
θ2	5°	7°	9°

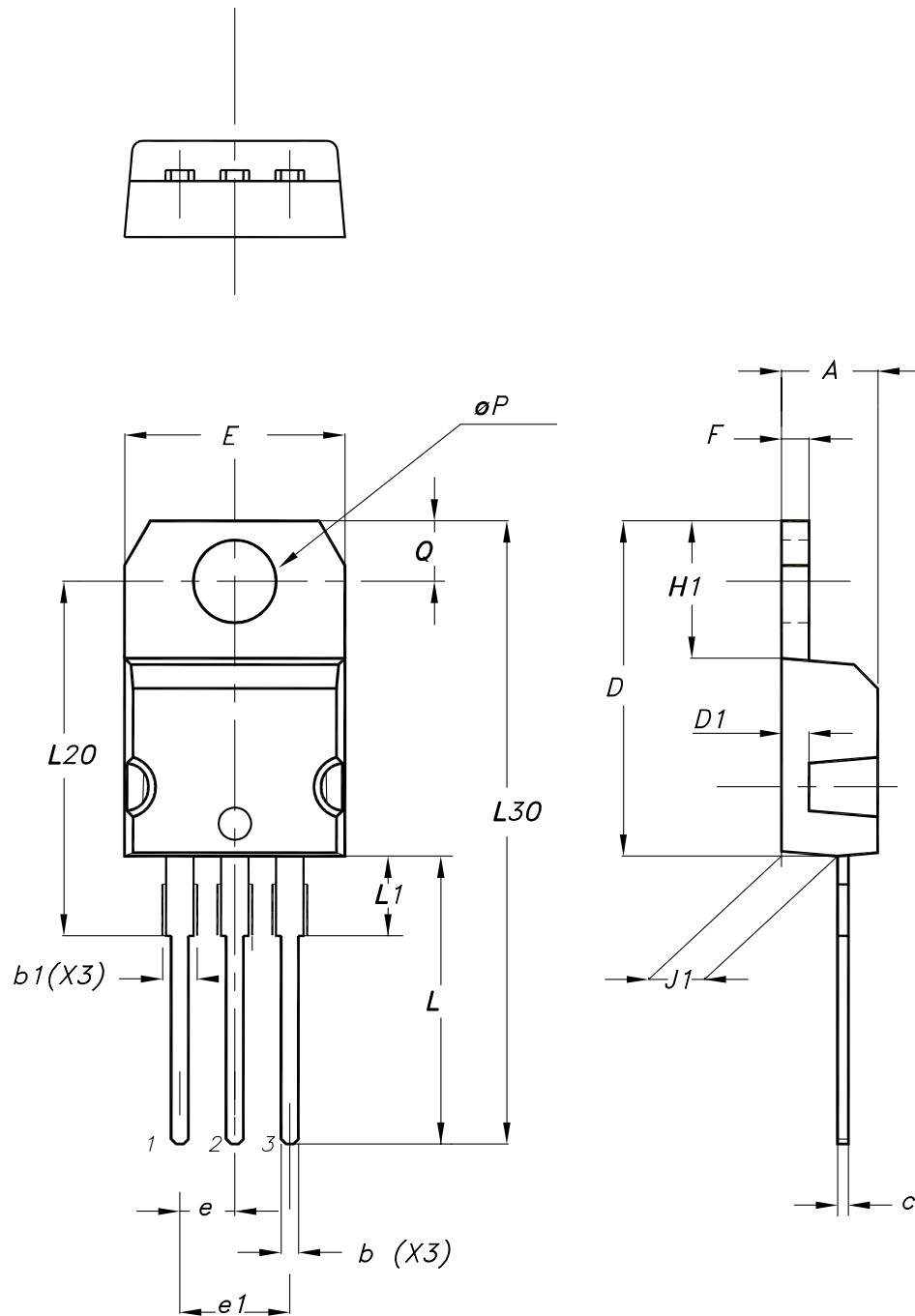
Technical drawing of a mechanical part. The drawing shows a top view and a side view. The top view is a rectangle with a width of 6.3 and a height of 6.5. The side view is a rectangle with a width of 11.2 and a height of 1.8 MIN. The part has two rectangular features on the top surface, each with a width of 1.5 and a height of 2.9. The distance between the centers of these two features is 4.572. The drawing includes section lines (hatching) and dimension lines with arrows. A section line A-A is shown at the bottom, and a section line B-B is shown on the right.

2) The device must be positioned within ± 0.05 A B

page 17/26

4.4 TO-220 type A package information

Figure 25. TO-220 type A package outline



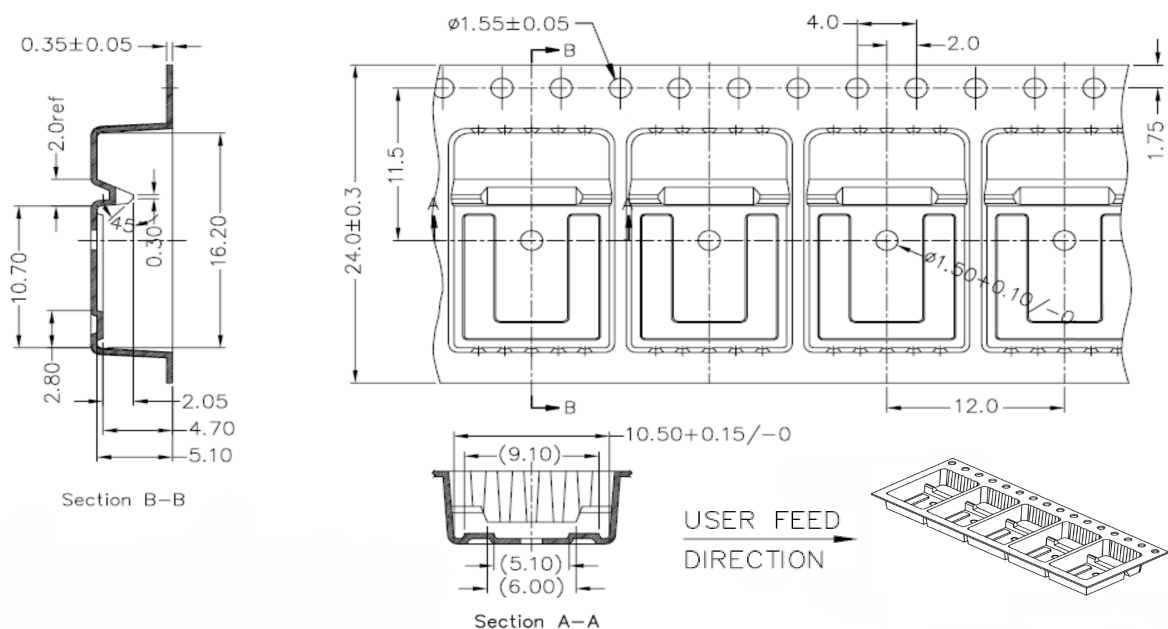
0015988_typeA_Rev_24

Table 11. TO-220 type A package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.55
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10.00		10.40
e	2.40		2.70
e1	4.95		5.15
F	1.23		1.32
H1	6.20		6.60
J1	2.40		2.72
L	13.00		14.00
L1	3.50		3.93
L20		16.40	
L30		28.90	
øP	3.75		3.85
Q	2.65		2.95
Slug flatness		0.03	0.10

4.5 D²PAK packing information

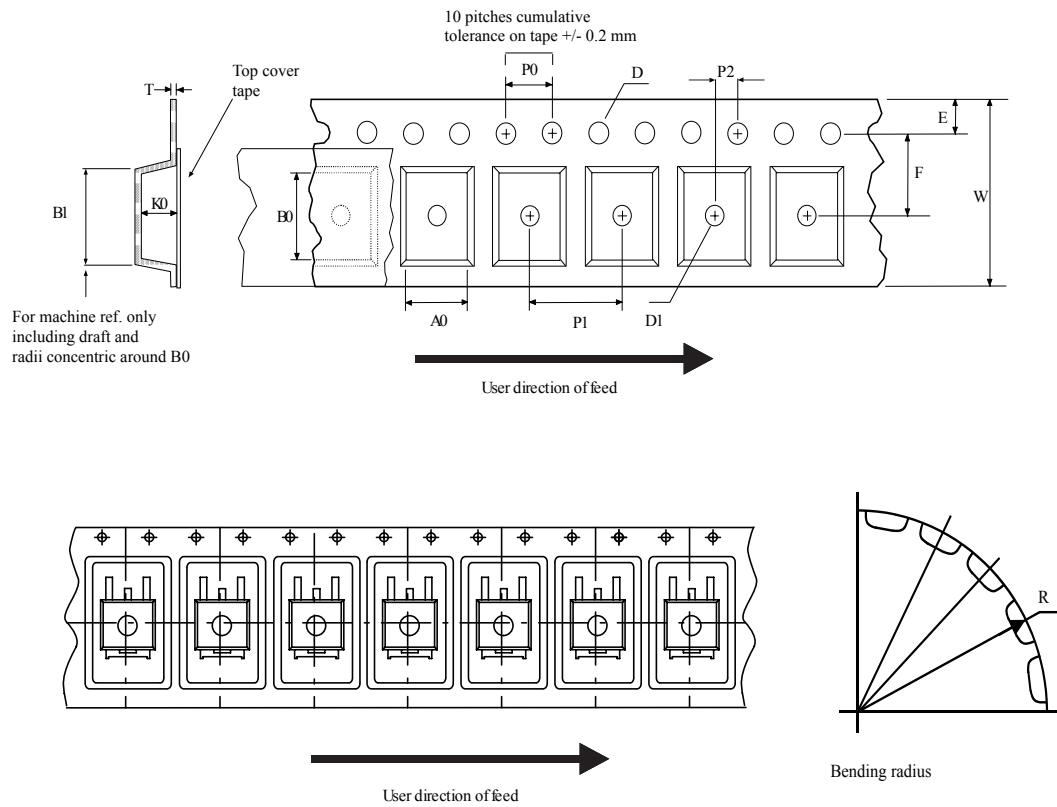
Figure 26. D²PAK tape drawing (dimensions are in mm)



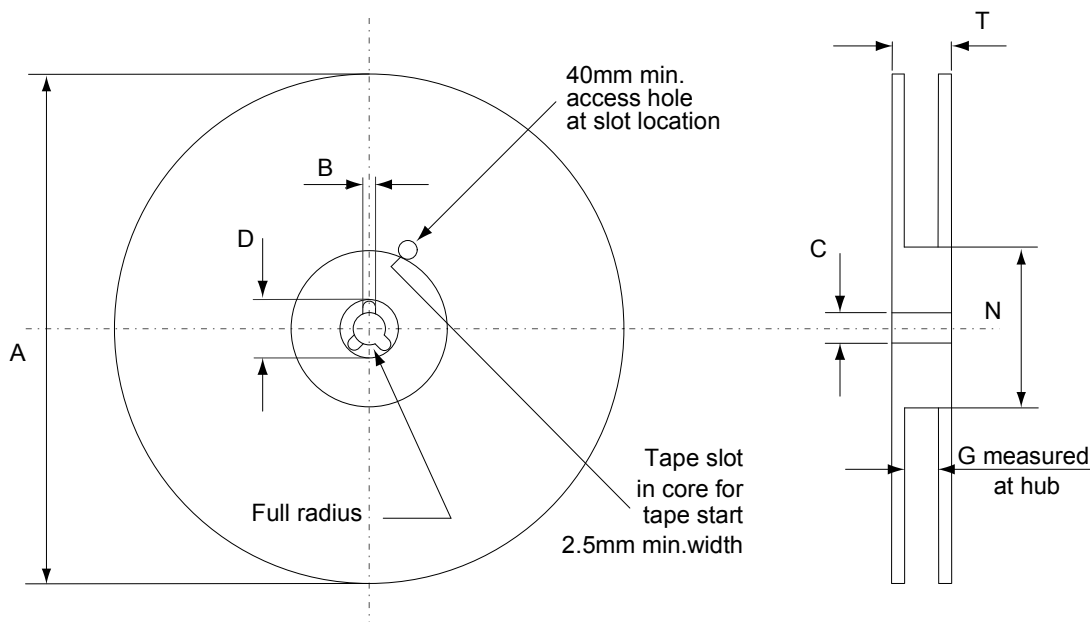
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4.6 DPAK (TO-252) packing information

Figure 27. DPAK (TO-252) tape outline



AM08852v1

Figure 28. DPAK (TO-252) reel outline


AM06038v1

Table 12. DPAK (TO-252) tape and reel mechanical data

Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
A0	6.8	7	A		330
B0	10.4	10.6	B	1.5	
B1		12.1	C	12.8	13.2
D	1.5	1.6	D	20.2	
D1	1.5		G	16.4	18.4
E	1.65	1.85	N	50	
F	7.4	7.6	T		22.4
K0	2.55	2.75			
P0	3.9	4.1	Base qty.		2500
P1	7.9	8.1	Bulk qty.		2500
P2	1.9	2.1			
R	40				
T	0.25	0.35			
W	15.7	16.3			



5 Ordering information

Table 13. Order codes

Order codes	Marking	Package	Packing
STGB8NC60KDT4	GB8NC60KD	D ² PAK	Tape and reel
STGD8NC60KDT4	GD8NC60KD	DPAK	
STGP8NC60KD	GP8NC60KD	TO-220	Tube

Revision history

Table 14. Document revision history

Date	Revision	Changes
02-Oct-2007	1	First release.
01-Apr-2008	2	Updated <i>Figure 14</i> and <i>Figure 17</i>
09-Jun-2023	3	Updated the entire <i>Section 4 Package information</i> . Minor text changes.
05-May-2025	4	The part number STGF8NC60KD has been removed and the document has been updated accordingly. Updated Section 4: Package information .



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4.3	DPAK (TO-252) type C3 package information	15
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